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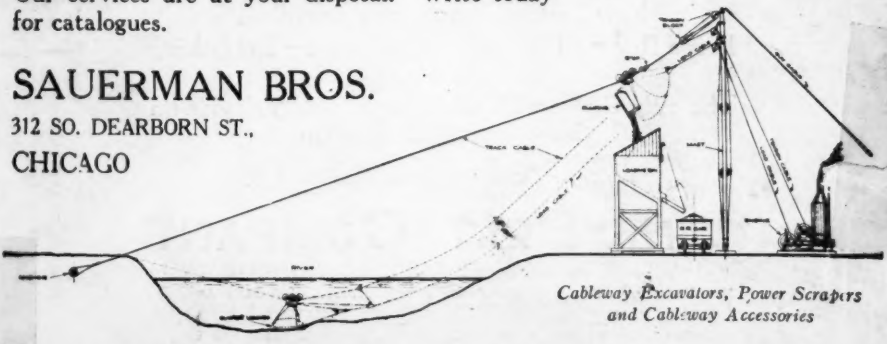

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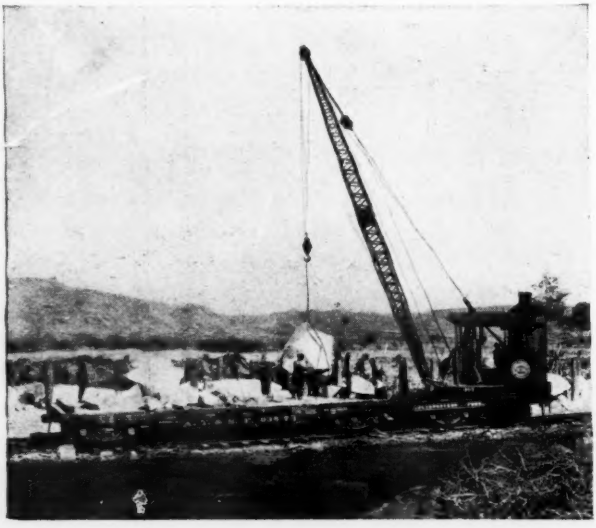

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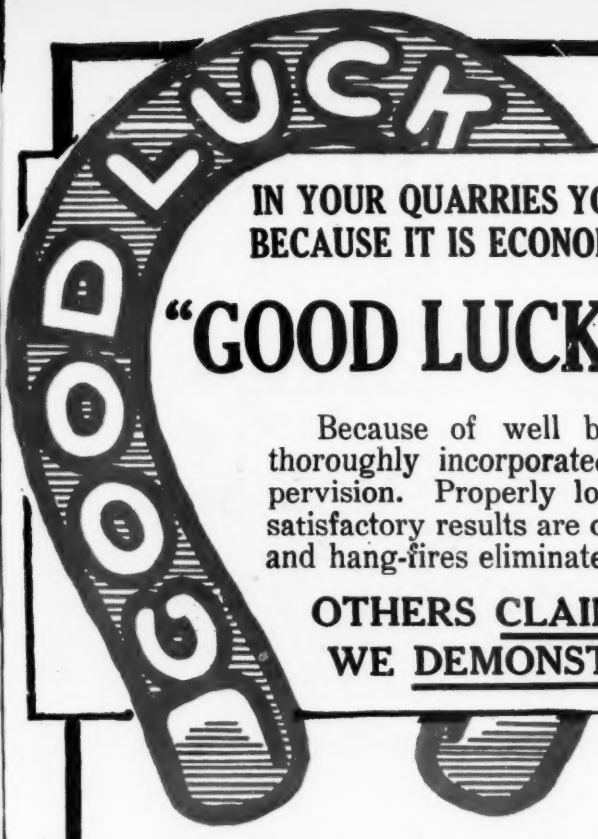

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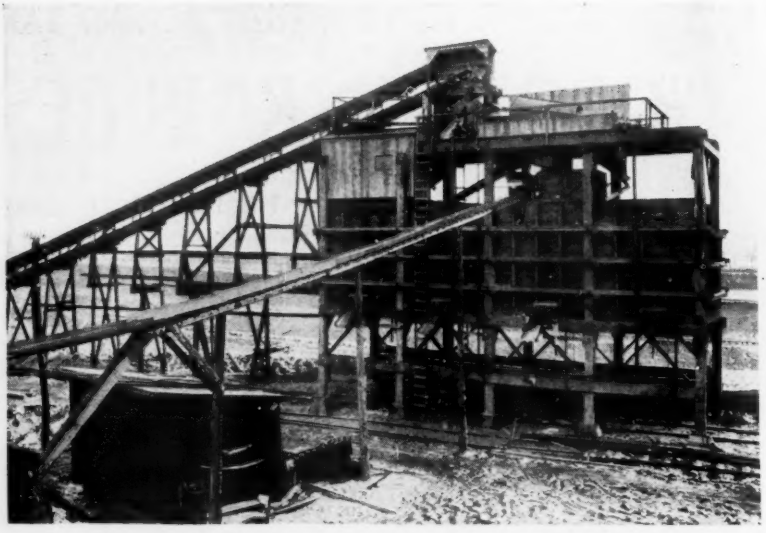

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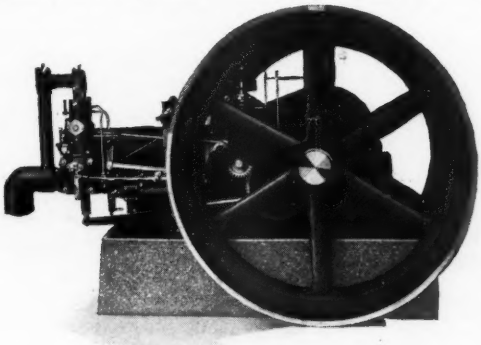

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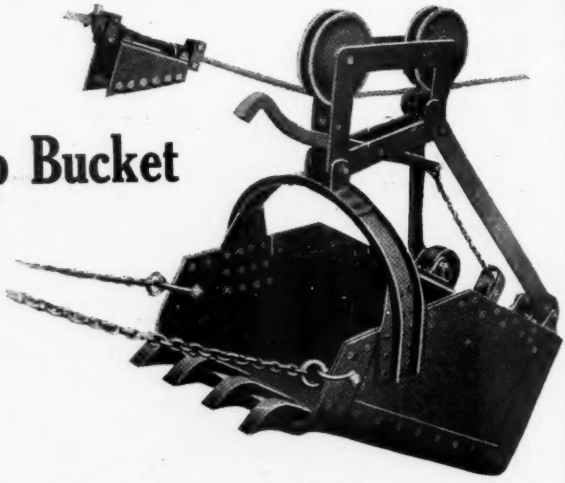

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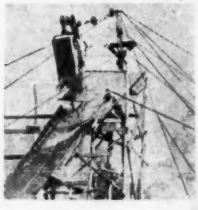

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Pit and Quarry

Vol. I **OCTOBER, 1916** **No. 1**

A Journal for Producers and Marketers of Sand, Gravel and Stone.

Subscription Price $1.00 *Per Year.*

Address Pit and Quarry, 527-529 S. La Salle Street, Chicago.

Some Good Reasons.

In handing you the first issue of our new publication, we shall try to follow the rule which we have imposed upon ourselves of being brief and to the point.

Producers of Sand, Gravel and Crushed Stone have in the past found it necessary to be content with such space as was given them in journals impinging to a limited extent on their field. This has been most unsatisfactory from the standpoint of the reader and the advertiser, until the time has arrived when, in the rapid growth of the industry, a publication like PIT AND QUARRY is absolutely demanded. The phenomenal increase in the use of concrete for all classes of construction has given a wonderful impetus to the business of the men who own and operate pits and quarries. Think, for a moment, that at the present rate of consumption of cement in this country, at least 60,000,000 cubic yards of aggregates must be produced annually for concrete work alone.

PIT AND QUARRY is the response to the demand of this industry. Its sole purpose is to give the men in the Sand, Gravel and Stone business a specialized publication, all of it devoted to their interests and taking up their problems in a detailed way which would not be possible for publications having other interests to serve; and also to furnish to advertisers a direct medium for reaching these men without having to pay for a large amount of waste circulation.

At Your Service.

The editor will be the chief servant of the industry, ready to fetch and carry for the general good.

He is making arrangements to secure helpful articles from men who are specialists in pit and quarry practice—men whose names are known throughout the industry. He will also be in the field himself much of the time, studying the needs of these men, getting first-hand information on new methods, describing recently constructed plants.

PIT AND QUARRY does not intend to indulge in long-winded articles or fine-spun theories. The editor will remember that the pages are small and will fill up rapidly. He will also remember that the men for whom he is writing are busy men, men who want practical ideas presented so that they can be grasped readily.

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This one publication will allow you to cover the field completely, at a moderate rate, in place of the incomplete and expensive distribution you are probably getting by advertising in several journals, each of which may partly cover the industry.

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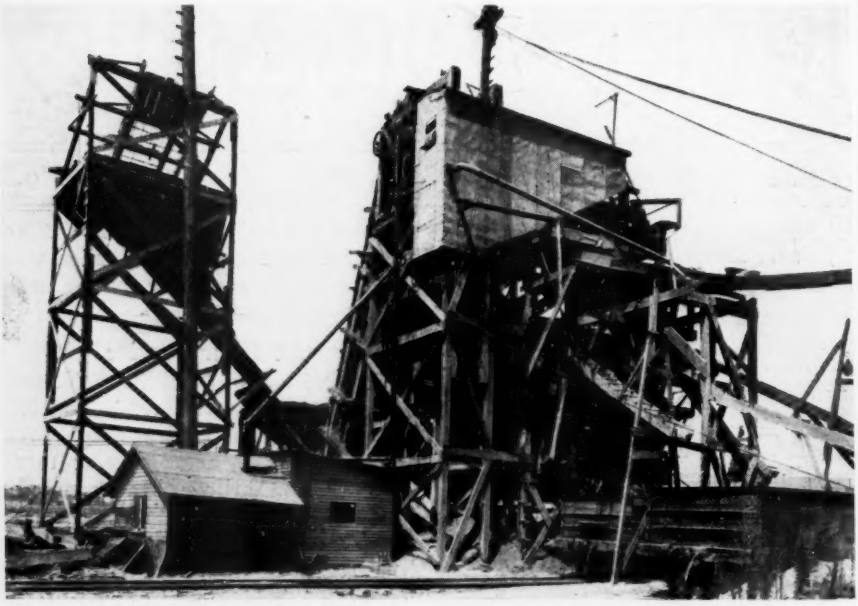


A MODERN SAND AND GRAVEL PLANT.

By F. M. WELCH and MINER RAYMOND.

To the ordinary citizen (even as you and me) the State of Indiana stands for three things—Lights of Modern Literature, Charles K. Fairbanks, and Sand. Hoosier authors have given their poetry and prose to the American public after an assiduous courtship of the proper Muse, and Mr. Fairbanks has devoted a studious lifetime to serving the Republican party; but it is only recently that Indiana Sand and its larger and more important relative, Gravel, have had the benefit of careful preparation before metamophosis into building materials of great economic importance.

The great dunes of the Indiana shores of Lake Michigan are widely known, but within the boundaries of the state are great beds of building sand mixed with valuable gravel in varying sizes. Local conditions surrounding these beds vary greatly and questions of proper methods of separation and washing can not be solved by any hard-and-fast rule or cut-and-dried plant design. Each case should receive special study at the hands of an expert in the production of these very necessary building materials, and it is with the solution of one such case that this article deals.

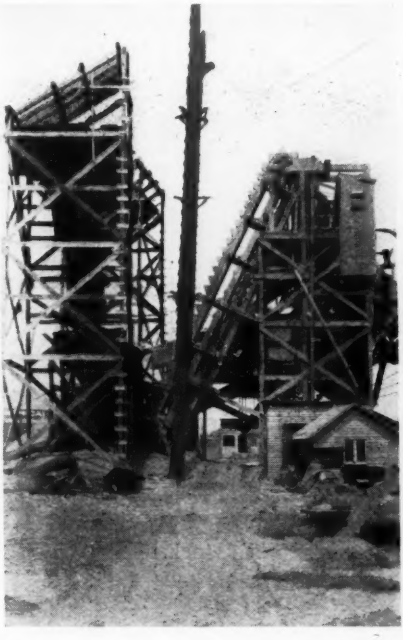
The plant in question is operated in the outskirts of Indianapolis by the Granite Sand and Gravel Company, with Mr. George V. Miller as general superintendent. At present, mixed sand and gravel is dug from a pit filled with water to a considerable depth. In fact, water is close to the surface throughout the property—a valuable item in the economic production of a cleanly washed product.

Two independent Shearer & Mayer dragline excavators are used to scoop up the material and carry it to the plant, where each excavator discharges its load into a separate hopper. These hoppers are set on either

side of the elevator and discharge directly into it through slide gates, by which the flow to the elevator buckets is regulated. One of the draglines is operated by a 50-horsepower, two-speed Thomas electric hoist with General Electric motor, and the other has the same equipment in 90-horsepower capacity.

The wet but extremely abrasive material is carried to the top of the plant in buckets 27 inches wide and of 14 inch projection, made of 3-16 inch steel and mounted between two strands of steel bar chain having 6½ inch flanged rollers and a double set of bushings at each articulation point. Passing over the head sprockets, which are of cast steel, the buckets discharge through a steel spout into the screen, accompanied by a 6 inch stream of washing water.

The screen proper is 48 inches in diameter and 20 feet long, with a sand jacket 72 inches in diameter and 9 feet long. The construction details of the screening surfaces can be seen in the accompanying photographs. At the receiving end is a preliminary washing drum 4 feet long, where the material receives a thorough scrubbing. This end of the screen is supported by trunnion wheels rolling on a steel ring attached to the screen, and heavy steel tires are shrunk on the circumferences of both wheels and ring to provide a tough wearing surface. The opposite end is supported by a gudgeon and bearing, made hollow to permit the passage of water pipes to the interior of the screen and jacket for thoroughly spraying and rinsing the sand and gravel, the first washing water passing off when the material leaves the drum.



Side View of Plant, Drag-Line Mast in Center, Hopper at Left, Elevator and Bins at Right.

Aside from the double dragline, one of the best features of the plant is the arrangement of screening surfaces and auxiliary spouting. A detailed description of the system would be tedious, but an idea of the completeness of the equipment can be gained by

One of Two Drag Lines Bringing in a Load.

Water Chute to Waste Hole.

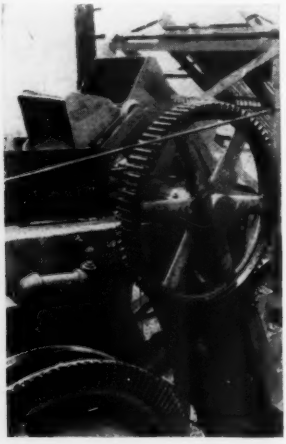
The Screen, Looking Toward Receiving End.

noting the following sizes of clean, sharply separated material that can be produced *without any cessation of plant operation:*

(1) Run of bank.
(2) 2 inch and larger.
(3) 2 to 1 inch.
(4) 2 to 5-32 inch.
(5) 2 to ¼ inch.
(6) 1 to 5-32 inch.
(7) 1 to ¼ inch.
(8) Roofing gravel.
(9) Coarse sand.
(10) Fine sand.

Normally, all material over 2 inch is rejected from the discharge end of the screen to an 8x14 inch Smith crusher, from which it is returned to the elevator for re-screening.

In addition to the above, the plant can produce sand of any degree of fineness, or any percentage of it can be wasted if so desired. Coarse sand can be saved and the fine wasted, or vice versa, by a mere shifting of valve levers. Either fine or coarse sand can be spouted into cars on either of the two loading tracks, separately or in combination with any of the various sized gravels. The bins are arranged to spout to the cars on one side or to wagons on the other.



Buckets Discharging at Head of Elevator.

The water piping is put in so that part, or all, of the material can be sprayed while in the sandjacket, according to whether or not some of the coarse sand is run with the gravel. All of the material receives a thorough washing and after the dirty water has passed off, a thorough rinsing in clean water, and yet the arrangement is such that no water reaches the gravel bins.

All water passes with the finest sand to an automatic settling tank, from which the dirt-laden water overflows to the waste hole and clean sand is loaded into cars. Settling tanks are often the source of much trouble but this one has never required the least adjustment since its installation.

The present plant stands on the site of an old plant. The new installation was designed from blue prints of the old plant by the Webster Manufacturing Company of Tiffin, Ohio, and the equipment manufactured and installed to handle 70 cubic yards per hour, a capacity which has been easily reached in normal operation.

As the accompanying photographs show, one of the chief features of the plant as a whole is its compactness. The topmost point of the structure is less than 47 feet from the ground, showing a rather remarkable saving in timber work and cost of construction when the volume of the output is considered.

Electric drive is used throughout. The motor equipment for the draglines has already been noted. The crusher is driven by a 15-horsepower General Electric motor, screen and elevator by 20-horsepower, and two additional motors of this latter size to drive the two No. 6 pumps, one of which is a Fairbanks-Morse and the other an American.

WHY SPECIFY "SHARP" SAND?

BY ERNEST McCULLOUGH.

Human beings have a number of little "dewdads" in their systems which medical men can apparently find no reasonable excuse for retaining, prominent among them being the appendix. This organ seems to persist and most medical men advise its elimination. To be sure, a man arises occasionally who gives an apparently sensible cause for the continuance of the appendix; but he never seems to prove his case, and people continue to have the appendix removed whenever it gives evidence of its presence.

Since nature is so slow in the elimination process, it seems absurd for human beings, like the writer for example, to be impatient when useless clauses are retained in specifications. There is a difference, however. The human body was evolved in the course of unnumbered centuries from lower orders of life, and in the gradually changing process it is to be expected that some things would last. We got rid of the tail, and the shape of the foot changed so that we are two-footed and two-handed instead of having four hands, like our relations who took another path after leaving the haunts of our common ancestor, and retained their tails and have hands which serve as feet. Specifications are recent things.

Concrete was made centuries ago and some of the concrete work of the old Romans is as good as the best made today, while, of course, some is very poor, even if it has lasted so long. We do not know what specifications they used so do not know whether they specified "sharp" sand. We do know, however, that an Englishman about a century ago knew how to make good concrete and he owned a fine deposit of sand which was described as "sharp," so as people thought the virtue lay in the sand they religiously followed his specifications when he told them the sand had to be "sharp." The fact that he owned the only bank of sharp sand for many miles never caused a ripple of apprehension that he might have been interested in seeing his particular brand of sand used. To this day the average specification writer, and indeed, many who seem apparently to be slightly above the average in intelligence, call in their specifications for "sharp" sand.

The writer would like to know just what is meant by "sharp" sand. He realizes that he is getting very close to the half century mark in age and that he has been actively practicing for close to thirty years and has mixed, and bossed the mixing of, concrete every year of that time; nevertheless he has never been able to find a single person who can describe "sharp" sand so it is differentiated from ordinary sand. He has searched earnestly and failed to find any man who can give a good reason why "sharp" sand is specified, other than that it has "always been done." Modern experimenters find that most sand has rounded grains and that the shape of the grain seemingly does not affect the strength of the concrete. Apparently the concrete is stronger if the sand ranges in size from fine to coarse instead of being fairly uniform in size of grains, but this is only apparent when the sand is not very fine. Fine sand with grains fairly uniform in size requires considerable cement to make a strong concrete, but the effect seems to be concerned with the distribution of sizes of grains and has nothing whatever to do with the roundness or the raggedness of the surface of the grains.

The advice of the writer to specification writers is to discard the use of the word "sharp" in sand specifications.

GRAVEL AND SAND: THEIR ORIGIN AND VALUE AS CONCRETE AGGREGATES

Gravels have been formed from ledges of rock by frost action, dynamic changes, and processes of decay, and have been borne to their present resting places by ice and water, or both.

The origin of the ledge rock has a marked influence on the durability of the gravel. It might have been sedimentary, metamorphic, or of volcanic origin. During the processes of formation it may have been acted upon by different chemical or physical agents, thus increasing or decreasing its quality as a concrete stone. In re-assortment or re-working by glacial or other action the sedimentary gravels assume angular shapes rather than rounded pebbles.

Metamorphic and volcanic gravels, on the other hand, are generally rounded, and frequently pitted and roughened, giving them a high degree of adhesion when used with cement.

Some of the metamorphic gravels, as quartzite, work and polish to a smooth surface and lack this necessary binding quality. Metaphoric gravels found in swiftly flowing streams or subject to constant tidal action are generally very smooth and polished; sometimes slime covered and difficult to wash clean. Shales, shaly sandstones and limestones generally afford poor gravels; the first two tend to disintegrate, are laminated, and should always be avoided. Some limestones have sufficient hardness and durability, even though not sufficiently rounded and roughened, to give good adhesion to the cement.

Syenite, granite and chert afford good sources for gravel, the pebbles hard and durable, usually roughened and rounded, have pitted surfaces and of such size distribution that the grading is very good. Basalt, gabbro, andesite, diorite and diabase are more angular and subangular and are apt to be irregular in hardness due to minute pores in the rock. The above mentioned volcanic rocks are generally called traps. Gneiss when pure is laminated and when in the form of gravel is irregular in shape. Granite gneiss, on the other hand, is an excellent material. The schists, composed of interbedded sedimentary and volcanic rocks, are irregular in shape, very often contain an abundance of mica, and are poor aggregates for concrete.

The mineral constituents of a rock determine the durability to a considerable extent. If the rock is made up of hard minerals not easily soluble it will afford good gravel. The porosity of a rock has an important bearing on the character of the gravel it will yield. A very porous rock, particularly if of sedimentary origin, will give low strength and be readily affected by frost. The porosity of igneous rocks is due to the escaping steam during the formation of the rock. Many sandstones are low in strength as gravel, due to their porosity caused by the water borne fragments of which the rock has been formed.

The adhesion of the cement to the stone increases as the stone becomes more porous, and an even, smooth surfaced gravel is not as desirable as a roughened and rounded one. Toughness, resistance to wear, fire resistance, and hardness, together with a high specific gravity, are very desirable qualities. Roughness and a good distribution of sizes are very essential to give the desired degree of density.

Vegetation exerts considerable influence on the character of the gravel. Roots containing organic acids attack the mineral substances, the acid decomposing the silicates. Humus acid caused by vegetable decay will corrode quartzite pebbles. The humus acid also supplies a certain kind of

cement, cementing together gravel particles in the formation of hard pan.

Bank gravels are usually superior to river or lake deposits, the size assortment is generally better, the pebbles more roughened and freer from foreign accumulations.

Bank gravels are generally stained to a depth of several feet below the surface, sometimes to an extent causing disintegration. When overlaid with clay containing much iron, this upper stained gravel is apt to be brittle and unfit for use. When overlaid with sand or sandy loam and the material has a distinct color from the body of the deposit this material may be used without inferior results should no decayed vegetation be present.

Sands are formed from the rock or gravel particles that have not resisted the crushing or grinding action in the formation of the gravel or are caused by the decomposition or weathering due to chemical or physical changes. Volcanic sands are the portion of the finer material ejected during eruption. Quartz and feldspar are the most common of all minerals, hence quartz and feldspar are most frequently found in sand, particularly river deposits, where the mineral constituents have been gathered from many sources. The black sands represent concentrations of heavy and slightly altered materials. These are common in our local sands, giving to them a high specific gravity.

The coarser and better graded sands from the bank deposits are usually superior to the river and lake deposits in that they are freer from foreign accumulations and of better size assortment. Many river deposits show much variation in size. Some sizes may be entirely lacking; again the sizes may be sorted and deposited in regular order. Slack water deposits of sand are usually too fine and contain sediments that add nothing to their strength when used as aggregate.

The sharpness of a sand does not make it superior to a rounded grained sand, in fact the rounded grain will yield a more dense mortar than will the sharp grain. The smoothness of the grain will affect the adhesive quality as regards mortar mixtures. Should the sand be of a smooth, hard grain the ultimate strength of the cement will be the determining factor rather than the strength of the sand grain. In general, the physical characteristics of sands and gravels are similar, and what applies to one applies with equal force to the other when used as aggregates for concrete.

In conclusion, it might be well to state the value of a chemical analysis for sands even though they do not have a suspicious look. The presence of tannic acid, preventing the setting of cement, cannot be detected by visual means. This is of very rare occurrence and is seldom caused by natural means.

The wastes of paper, textile, silk mills, smelters and the like will introduce ruinous substances in deposits of sand or gravel.

Humus and other organic compounds may readily be contained in the overburden of the natural deposit and cause the work to be of inferior quality if not an entire failure. The presence of magnesium or sodium sulphate sometimes encountered in the construction of underground works will cause decomposition of the concrete, particularly if the concrete is of a porous nature. Sulphuric acid will convert the carbonate of lime into a soft, friable sulphate of lime (gypsum), a material having no cohesive strength. Ground waters containing soluble sulphates dissolve away certain of the calcium compounds of set cement, robbing the mortar of its cohesiveness and strength.

The action of the sulphates, though more readily attacking the cement, will also cause the aggregates to disintegrate in time.

Any More Architects Like This One?

Listen to this! A reinforced concrete building was being built, under supervision of the architect. The contractor was making his concrete carefully of washed and graded aggregates. The architect came along one morning and told him that his materials were better than necessary, that pit-run material could be secured which would answer the purpose just as well. Of course it might contain 7 or 8 per cent of clay, and an over supply of fine sand; but the clay would help to make it water-tight, and the fine material would not hurt anything.

We will hope that this is not a typical example of what is happening generally over the country. But the fact that this one instance has come to light shows that there is some educative work to be done along the line of the use of better aggregates. Some sand and gravel dealers are content to give a man what he asks for when he is buying aggregates. The more progressive ones are now establishing a custom of trying to show the purchaser the advantages of screened and washed materials in producing better concrete. This is not only good business but is in the interests of industrial welfare. With capital invested in a screening and washing plant and labor to operate it, as much of the output as possible should be made to help pay the interest on this investment; but above and beyond this consideration is that of the permanent well-being of concrete.

There is no alchemy about concrete. A good product cannot be made from poor materials, any more than steel can be made from lead ore.

Down Hill—Or Up?

The location of a pit or quarry with reference to the elevation of the surrounding territory is worth considering. On this depends whether one will have the advantage of a down-hill haul or the disadvantage of an up-hill haul.

One of the main advantages which a big Sand and Gravel concern in a middle western city has over its competitor is the fact that it is so situated that practically all of its deliveries are made on a down-grade. This is sufficient advantage, however, to enable it to figure a little closer on its haulage cost, and thus underbid its competitor where competition is close.

Got Enough Capital?

It takes money to run a plant as well as to build it. A designer of plants recently took a run out to look at some of his creations. Two of them were not in operation. Regarding them he says:

"One of the two we believe to be the best design which we ever made for the purpose. Though both of these plants are situated in the center of great activity in concrete construction, yet neither plant was running, both of these having the deserted appearance of a farmhouse that has not been occupied for years. Investigation disclosed that the reason why both of these excellent plants were idle was that their business history was one incident after another of financial mismanaging, starting with the fundamental error of having just enough capital to equip the plant and not a cent to run it on."

The Snyder Sand & Gravel Company, of Rock Island, Ill., brought suit for damages against the Lyons-Fulton Company, operating the bridge between Fulton, Ill., and Lyons, Iowa. One of the barges of the sand and gravel company struck a pier of the bridge because the pier was not protected by a sheer boom as directed by the war department. Damages amounting to $1,500 were claimed, but the board of arbitration awarded $910.

WEIGHT OF SAND AND GRAVEL PER CUBIC YARD.

According to the reports of 670 producers of Sand and 560 producers of Gravel who reported to the Geological Survey in cubic yards instead of tons, the weight of a cubic yard of sand varies from 2,200 to 4,000 pounds and the weight of a cubic yard of gravel from 2,200 pounds to 4,200 pounds. Any weight above 3,300 pounds a cubic yard for sand is very unusual, for of the 670 producers replying to the question, only 12 reported above that weight and only 22 reported above 3,000 pounds. It is surmised that the sands reported as weighing over 3,000 pounds were weighed wet, or that the reported weight was only a guess, or that the composition was unusual; for a cubic yard of pure quartz closely packed should weigh 3,240 pounds.

It may be that many of the weights reported to the Survey are guesses and not actual determinations, but even if this is so the expression of opinion of several hundred producers should give a very fair average weight. The average weights of sand and gravel in those States in which 10 or more producers reported figures are as follows: reports of 30 to 65 producers; the averages for the other States are from fewer producers. A cubic yard of sand of spherical grains of uniform size and a cubic yard of gravel of the same mineral composition and consisting of round pebbles, all of the same size, should have the same weight, for the pore space would be equal and about 27 per cent of the volume.

There are two principal reasons, however, why gravel weighs more than the same volume of sand. One is the difference in mineral composition, and the other the greater variation in size of component parts. Gravel is commonly composed of rock fragments which contain quartz, feldspar, and ferromagnesian minerals; quartz is the least soluble of these and forms the greater part of most sands, the heavier and more easily disintegrated minerals being reduced to silt. Sand, therefore, as a usual thing, is lighter than the gravel from which it is derived, because the lighter mineral forms a greater percentage of the whole. Second, sand is comparatively even-grained and, therefore, has considerable pore space, while the ordinary run of unsized gravel has a wide range in size of individual pebbles, which results in a considerable reduction in pore space. It is largely the lack of close sizing that gives ordinary gravel a greater weight per unit of volume than the same volume of sand.

REPORTED WEIGHTS OF SAND AND GRAVEL TO THE CUBIC YARD, IN POUNDS.

State.	Sand.	Gravel.	State.	Sand.	Gravel.
Alabama	2,505	2,790	Missouri	2,680	2,840
California	2,645	2,895	New Jersey	2,600	2,730
Florida	2,605	2,680	New York	2,590	2,760
Illinois	2,820	3,005	Ohio	2,700	2,830
Indiana	2,700	2,945	Oregon	2,620	2,880
Iowa	2,720	2,850	Pennsylvania	2,500	2,680
Kentucky	2,580	2,830	Texas	2,695	2,910
Massachusetts	2,710	2,810	Washington	2,930	3,065
Michigan	2,895	2,985	West Virginia	2,570	2,780
Minnesota	2,865	2,880	Wisconsin	2,800	2,970

It is noticeable that the highest average weights for both sand and gravel are shown by Illinois, Michigan, Minnesota, Washington, and Wisconsin.

The figures given for Illinois, Indiana, Iowa, Michigan, New York, Ohio, and Wisconsin are averages from the

THE OFFICE END OF A SAND AND GRAVEL BUSINESS.

A simple, yet efficient, office system has been worked out by the J. L. Shiely Company of St. Paul. This company has three large plants for the production of Sand and Gravel, and about 60 horses and 3 or 4 motor trucks are required to handle the business. A concern which is delivering this amount of output to a large number of customers must necessarily have a well-devised system in order to handle this business to the satisfaction of its patrons and without loss or unnecessary clerical labor on the part of its own organization.

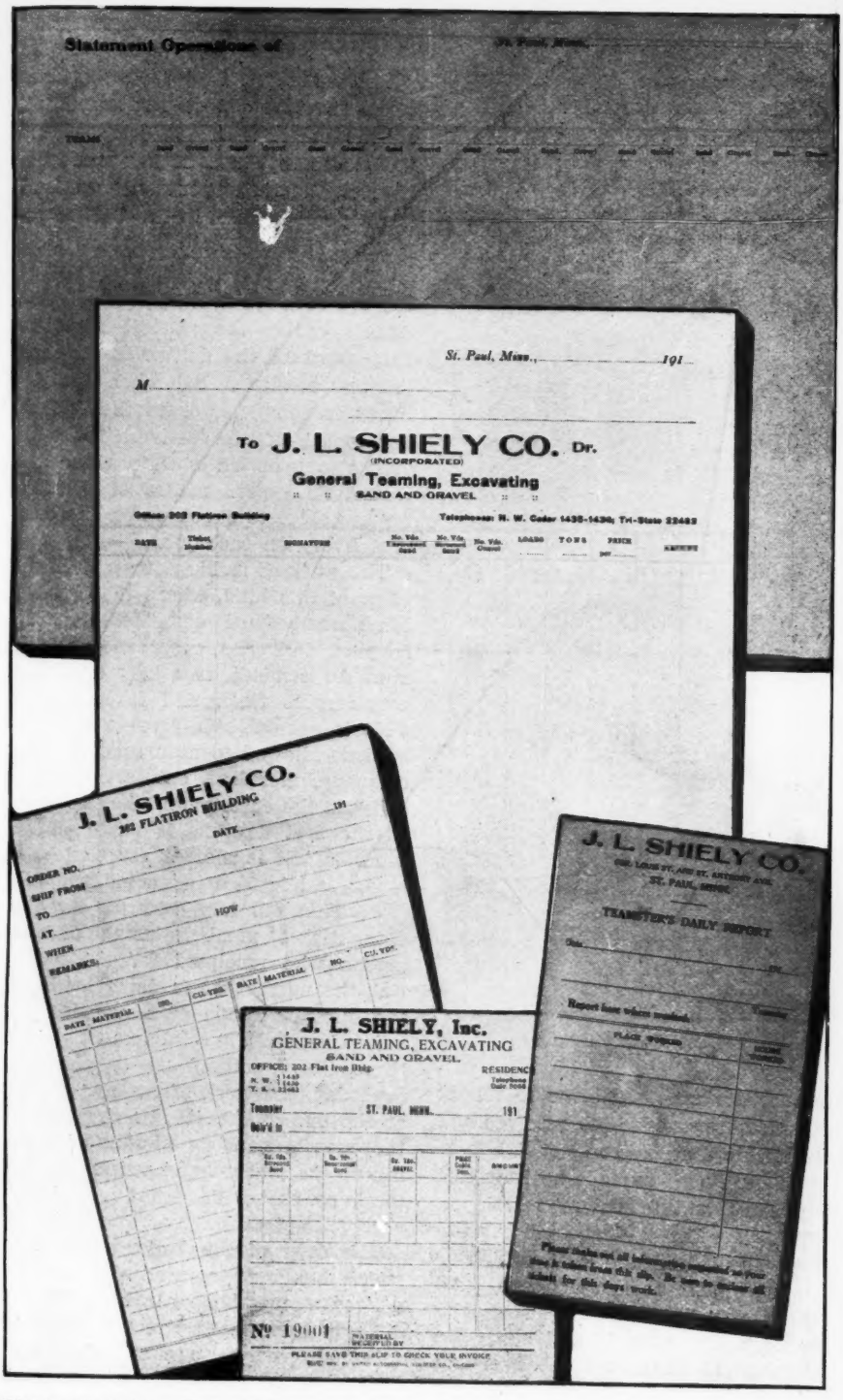
The system used by the J. L. Shiely Company has been developed by them from their experience, and is therefore fitted very closely to their particular needs.

The company maintains a general office downtown, where all orders are received and from which they are sent out to the different plants. The products of the different plants vary somewhat, so that when an order is received it is sent to the plant best adapted to fill it. If it is an order for material which can be delivered from more than one of the plants, it is, of course, usually sent to the plant which can make the delivery with the shortest haul. Other considerations might enter, however, such as the overcrowding of one plant, making it better at times to give the material a longer haul in order to equalize the work of production.

When an order is received it is made out in duplicate on an order blank, one copy being sent to the plant which is to deliver the material and the other retained at the office. If the order is for a variety of materials which must be shipped from different plants, a separate order is made out for the material from each plant. This order blank carries on the bottom a series of columns, in which the date and amount of deliveries can be entered. These are entered each day by the foreman at the plant on the order blank which is sent to him, and are also entered on the copy in the general office from the duplicate delivery tickets which are turned in by each teamster at the end of the day.

The delivery ticket is made out in triplicate at the plant for each load of material which goes out. One of the copies remains at the plant, one is given by the teamster to the customer's receiving clerk, and the other is sent to the main office at the end of the day with the teamster's daily report. These tickets are made in different colors for the different plants, so that it is an easy matter for the general office to keep a separate record of deliveries from each plant.

When the tickets are made out the time of leaving the pit is written on each ticket. Each load is then marked on what is called a "trip sheet." This trip sheet is very similar to the order sheets, only larger, and the driver's name is placed on the side, while on top are the names of the customers to whom deliveries are made, with lines designating whether he received Sand or Gravel, and how much of each,



Blanks Used by a St. Paul Firm—at the Top Is the Trip Sheet, Next the Bill Head, and Below the Order Blank, Delivery Ticket, and Teamster's Report, Which Later Is Printed on an Envelope in Which He Places the Duplicate Tickets for the Day.

Daily Report.

thereby enabling the office to tell at a glance how much each received and also if his order is completed.

A daily report is made up from this trip sheet and teamsters' envelopes, which gives the yardage each customer received, and the cost, which is all put in the revenue column. All expenses, including labor and machinery cost, are entered in the expense column, and from that the firm can tell whether it is operating the pit on a paying basis.

The teamster's daily report consists of an envelope with the report blank on the outside. He reports on this the places to which he has made deliveries, the time spent on each, and the pay-roll is made up from these reports. The duplicate delivery tickets on all deliveries made during the day are enclosed in the envelope. The tickets enable the general office to keep track of the deliveries on each job and render a bill when the delivery is complete, or at the end of the month if the deliveries extend over a long period of time, while the teamster's report makes it possible for the office to check up on the cost of delivery on each job.

The work of making out bills in an office of this kind, where there are a large number of customers having frequent deliveries, each one of which must be itemized, is a task requiring considerable time, and it is impossible to get out bills promptly if this work is allowed to accumulate. This company, therefore, enters the items daily on the customer's bill. As soon as the first delivery is made on an order, a bill is started for that customer and is filed in an indexed bill file. This bill has columns for the date, ticket number, name of the person who receipted for the material, the number of yards or loads of the different kinds of materials, the unit price, and the total amount. With these items entered up on the bill each day, the work of rendering bills at the end of the job, or the end of the month, consists simply of footing up the amount and writing in the total, so that bills can be rendered very promptly.

The copy of the order blank on which has been entered the various deliveries, together with the duplicate delivery tickets, constitute the office's itemized record, so that ledger entries need be made only of the total amount.

Specialization Means Growth.

If you stop to consider for a moment, you will realize that the rapid increase of trade papers—barring a few overcrowded fields, of course—makes for efficiency and better business, rather than the reverse. It is indicative of specialization—and specialization means intensive development, better business methods, closer attention to detail, more rapid growth.

We have the confidence to believe that PIT AND QUARRY will give an impetus to the industry it represents. That is what it is started for; and, if we may say it modestly, its sponsors are men with records of some accomplishment behind them.

We are starting out with the idea of giving service, and we expect to fight it out on that line.

Shall We Sell by Weight or by Volume?

In connection with the discussion now going on among dealers as to the advisability or advantage of selling Sand and Gravel by weight rather than by volume, attention is directed by the United States Geological Survey to the results of laboratory tests on Sands derived from 19 different localities in western Washington, furnished to the Survey by the analyst, Mr. R. J. Borhek, of Tacoma, Wash. Samples of sand were thoroughly dried, poured into a cylinder having a capacity of one-fifth of a cubic foot, shaken until settling ceased, and then weighed. The weights computed for a cubic yard range from 2,692 to 3,164 pounds, the average being 3,020 pounds for 19 samples.

On comparing this with the average of 2,930 pounds per cubic yard derived from the reports of 10 dealers in the same area, whose estimates ranged from 2,500 to 3,200 pounds per cubic yard, the suggestion at once arises that the consumer who buys Sand by the cubic yard may be getting nearly 100 pounds more per yard than the dealer estimates. It is obvious, however, that the consumer is at a disadvantage in purchasing Sand by weight if the material has not been dried and kept under cover, and most Sand is not so treated. A yard of building Sand would weigh more when it was just pumped from the river than after it had drained and dried on the dock, or more after a shower than after a day in the sun. Furthermore, weighing causes a slight loss of time in delivery.

The sale of Sand and Gravel by the yard, on the other hand, is haphazard, for wagon boxes vary in capacity, the exact capacity is not known to the loader, and one load may be heaped higher than another.

Car and Wagon Delivery.

In many cases it will be found necessary to build a gravel plant with provision for delivering to both wagons and cars on the same side of the bins. This can be done satisfactorily by having the team track close to the bins and the car track outside of this, the delivery to cars being made by means of belt conveyors. The delivery to cars may be from a higher level if desired, provided the bottoms of the bins are below car level, the chutes cutting into the bins at about the level of the top of a car, giving the conveyor a horizontal run. But this will be determined largely by the nature of the trade. If the bulk of the business goes out in cars the openings which feed the cars should be near the bottom of the bins, even though the belt conveyors must be so designed to lift the material over the side of the car.

A sand and gravel plant has just been established at Barry, Ill., by the Barry Sand & Gravel Company. This company has a capital of $35,000. The incorporators are George Edward Hoffman, John C. Brendt and Joseph Webb.

Plant of Penn Sand & Gravel Company at Tullytown, Pa.

PENN WASHING AND SCREENING PLANT.

BY H. D. PRATT,
Engineer, Link-Belt Company, Philadelphia.

The illustrations show a Sand and Gravel washing and screening plant, designed and built by the Link-Belt Company, Philadelphia, for the Penn Sand & Gravel Company, at Tullytown, Pa. It is a good example of a high capacity outfit which requires very few men in its operation, and is easily maintained.

Material is brought to the plant by 2-yard cars loaded by a dragline excavator. The cars dump into a large track hopper, delivering through a gate to either of two skip hoists of 4½-yard capacity each. The skips are counterbalanced, so that the power required is that necessary to raise the Gravel only. The skips dump into a large bin at the top of the plant. From this bin material is flumed by means of jets of water to three sets of Gilbert type conical screens, which size the Gravel and deliver to the bins. The Sand and water are separated by a series of three counterweighted separators at the Sand partition end of the bin, and the water is flumed away to a nearby field.

The rejections from a bar screen in the hopper at the top of the plant are chuted back to a pair of Symons crushers located at the right, where the oversize is crushed and delivered by means of an inclined belt conveyor back to the original dump hopper, and in this way re-elevated to the skip hoists and carried up to the bins.

The plant has a capacity of over 1,000 yards per day. The skip hoists have a capacity of twice this in the event that another bin and a set of screens are added to the plant at the left of the skipway.

Water is delivered to the screens and bins located under the skip hoist by means of a two-stage centrifugal pump, operating against a total head of about 90 feet. The screens are driven through a light rope drive from the engine room, located on the ground.

The large bin at the top of the plant

Material Carried Up by Skips.

insures a uniform delivery or stream of material to the screens, which keeps them working well below their rated capacity. This avoids operation at overload or empty, as is sometimes found where skip hoists feed screens direct, instead of dumping into a bin. The flow of material in the Penn Sand & Gravel Company's plant is steady, such as obtained from a belt conveyor or bucket elevator.

Delivery to railroad cars is made from either side of the bin. The cars are pulled along the track by a winch and wire rope, doing away with the necessity of shifting by locomotive, making the plant independent of the railroad shifts.

Good Sand and Gravel Plant.

A remarkably efficient Sand and Gravel handling plant has recently been put in operation by J. W. Thompson near Anchorage, Louisiana.

The Gravel and Sand, obtained from Profit Island, about 20 miles distant, by four suction dredges, is brought to the plant in barges and is there unloaded by means of a floating stiff-leg derrick operating a 3-yard clam-shell bucket. The bucket dumps into a large hopper, also mounted on the derrick barge, from which the material is loaded into an 11-yard car, and is then drawn up an incline track laid upon the sloping levee.

This plant was designed by Grenneke & Fay of St. Louis.

This stiff-leg derrick was furnished by the Lidgerwood Manufacturing Company. It has a 62-foot boom and a 16-foot bullwheel. The bucket is operated at a 47-foot working radius. This bucket was furnished by the Andresen-Evans Company and it weighs approximately 7,500 pounds. All the wire rope furnished on the derrick and bucket was Leschen's patent flattened strand Hercules, about 1,300 feet being required in ¾-, ⅞- and 1-inch diameters.

At the top of this incline track the car dumps into a second hopper, which loads the Sand and Gravel on to a 30-inch inclined belt conveyor leading to the bin beyond. As the long dimension of the bin is at right angles to this conveyor, it is necessary to transfer the material to a second belt running horizontally along the long axis of the bin. This conveyor is equipped with an automatically propelled tripper, which travels back and forth and loads the material uniformly into the bin.

When desired, the Sand and Gravel can be transferred, by means of the tripper and chute, from this second conveyor to a third one, on which it is elevated to a washing table. Here the material is thoroughly mixed with water, and is then carried by means of sluices over various sized screens, which separate it into the different common commercial sizes, the excess sand and dirt being carried back with the washing water into the river.

From the bin the material is loaded directly into cars through gates in the floor, the bin being wide enough throughout its full length to accommodate two tracks.

The storage and loading bin is 28x130 feet in plan with walls 15 feet high, giving a total storage capacity of about 2,000 yards. About five-eighths of the total length of the bin is devoted to the storage and handling of the mixed Sand and Gravel just as it is obtained from the river, this portion of the bin being loaded from the second conveyor mentioned previously. The remaining three-eights of the bin is divided into a number of compartments, and is devoted to the various sizes of washed and screened material.

The whole plant is designed for a normal working capacity of 2,000 yards, or approximately sixty cars per day.

PREPAREDNESS.

BY RAYMOND W. DULL

Whatever we may think of national preparedness for defense, the term is surely applicable in the industrial and commercial world to our everyday business security. The man who allows his business methods, his plant equipment and commercial wares to fall behind is lost. He must be prepared for any onslaught by a competitor. The first thing he knows a competitor whom he has always considered a Japanese has landed his force right into his territory. Now if this "Jap" has modern, up-to-date equipment and plenty of energy, our man who has been asleep at the switch, who has not prepared, wakes up some morning and finds that the enemy has captured his strongest fort, has secured the contracts he considered his bread and butter for the next ten years.

His first thought is to find out how it was done. He sends out a few scouts and finds that his competitor has only five men running his plant, while he himself has twenty-three doing the same work. But the scouts also report that the competitor has modern machine guns in the shape of the very latest labor-saving equipment, while he has still the old muzzle-loading equipment.

He decides that his only hope is to give battle; so he proceeds to cut prices. He is answered at once by the enemy's long range guns in the shape of lower production costs. He is soon hammered out of his hurriedly dug trenches, for his old guns will not carry far enough to reach the enemy and he is forced to run up the white flag.

How much better would it have been if he had been prepared.

But you say that it is foolishness to throw away machinery when it is not entirely worn out; that you are still able to patch it up and get something out of it. Do you know that manufacturers in various lines are constantly throwing out machine tools which are worn but very little? The reason is this: Someone has a new machine which will turn out twice the amount of work, and the added earnings of this new machine pay for it in less than a year. But you protest that you have not the money to buy the new one. Your out-of-date machinery has earned you so little that you cannot make the raise. Well, go borrow—get in debt—but be up-to-date and prepared. When your enemy sends his scouts over to see what you have, they report that your navy is "fit" and your artillery is the very best. Your competitor leaves you alone and scouts around some place to find someone elsewhere who is not prepared.

The writer has been a manufacturer of "munitions" for Sand and Gravel plants and we are free to confess that we find a great many plants still using the old muzzle-loading equipment. We are glad to see, however, that there is a general awakening and specialists are being called in to put plants up-to-date.

Now a word about the specialist. If his "munitions" are not good he will not last very long. If the shells are filled with poor powder and fail to explode when tested, he will soon drop out of business. He, too, has built his forts on loose sand and has not prepared himself to withstand the searchlights of modern efficiency.

The "munition" maker who is making the best high-power guns is the man to go to, even if the guns cost a little more. You are prepared then for highest efficiency and a more prosperous business.

What appears to be the tusk of an extinct North-American elephant was unearthed recently at a depth of 20 feet at the plant of the Ideal Sand & Gravel Company at Mason City, Iowa.

Motor Trucks.

A Sand and Gravel concern in Kansas City not long ago sold its teams and wagons and adopted the motor truck exclusively for delivery purposes.

These men must have figured out to a mathematical certainty that they were going to gain by the change or they would not have made so radical a move.

It is, of course, too soon to determine anything of value regarding the difference in cost, which must necessarily depend upon records covering a considerable period of time; but the increased speed and efficiency of delivery is already considered worth while.

The Gates Sand and Gravel Company of Charleston, W. Va., recently made a very satisfactory record with a seven-ton Sterling motor truck, made by the Sterling Motor Truck Company of Milwaukee.

In 10 hours this truck made 18 round trips of 2.4 miles to the round trip and one round trip of 8 miles. The latter was the first trip made during the day, and the schedule was as follows:

Truck left the garage at	7:00 A. M.
Gravel plant at	7:10 A. M.
Started loading	7:23 A. M.
Loaded	7:29 A. M.
Haul 4 miles	7:58 A. M.
Waited on contractor	8:10 A. M.
Unloaded at	8:15 A. M.
Back to gravel plant	8:30 A. M.
Loaded	8:39 A. M.

The truck took a load of 5 yards each time, making a total of 95 yards of material moved and a total mileage run of 51.2 miles. This was done on 25 gallons of gasoline and 1 gallon of oil, costing together $4.

The economy of using a motor truck for hauling Sand and Gravel has also been demonstrated by H. A. Maine & Co., of Waterloo and Des Moines, Iowa. This company has made extensive use of a Dart 2½-ton worm-drive truck, equipped with a hand hoist and dump body, for hauling Sand and Gravel from an elevator or hopper nine miles out into the country for road work.

The truck hauls 2 yards of Sand and makes four trips per day, and in doing so is doing the work of four teams, as heretofore. Mr. Maine has hauled the Sand and Gravel with teams, and a team hauled two yards and made one trip per day. He paid $5.50 per day for the team, so the truck is doing the work that formerly cost $22 a day, and is doing it at a total cost of $10.22. The actual cost of $10.22 is itemized as follows:

Gasoline	$ 2.25
Oil and Grease	.24
Tires	1.87
Driver	3.00
Depreciation	1.50
Interest at 6 per cent	.45
Insurance	.16
Repairs, painting and overhauling	.75
Total	$10.22

This includes every possible charge that can be made against the truck, and this also means that Mr. Maine can throw the truck away at the end of five years, as he will have charged it off at $1.50 per day.

Investigate the Supply.

The first essential to success in the Sand and Gravel business is a plentiful supply of the raw material. This looks like such a transparent and self-evident statement as to make the printing of it appear foolish and unnecessary; but there came to light just recently the case of a man who spent upwards of twenty thousand dollars to build and equip such a plant, only to find after running a few months that his vein of material was but a few feet deep. This means that the supply available within the radius of his drag-line will soon be exhausted, and that if he is to continue in business and earn anything on his investment he will soon have to acquire more land, move his excavating equipment or acquire more, and put in some kind of a system for transporting his materials from the pit to the screens and washers.

Plant of France Stone Company, Monroe, Mich.

A STONE PLANT OF MODERN TYPE.

One of the largest stone companies to be found operating in Ohio, Michigan or Indiana is the France Stone Company, with headquarters at Toledo, Ohio. This company has plants in all of these states, having in all fifteen plants for the production of Stone and five plants for the production of slag.

Storage and Delivery.

A most interesting exhibit is that at the general office of the company, comprising a series of cases with glass fronts, showing the stone which comes from the various quarries and the different sizes produced. Practically all of the stone is a hard grade of limestone, and in addition to being used for concrete aggregate, is sold very largely for railroad ballast and for macadam paving and stone road construction.

The most recently constructed plant owned by the company, and perhaps the most modern and efficient, is that located at Monroe, Mich. This plant has a capacity of 90 to 100 cars per day. It has direct connection with the New York Central Railroad, and through this road, with others entering Monroe, as well as with the network of railroads radiating from Toledo and Detroit.

This plant is on the site of an old and much smaller plant, which was destroyed by fire, and alongside of a large and seemingly inexhaustible supply of a first-class grade of limestone.

This stone comes prctically to the surface of the ground, making little or no stripping necessary. Drilling is done with two Loomis drills, boring 5-inch holes 40 feet deep and about 10 feet apart. These are loaded with about 250 pounds each of Aetna or Trojan 40 per cent dynamite to the hole. This breaks up the stone suf-

View of Quarry, Showing Marion Shovels, Layout of Tracks, and Incline to Crusher.

ficiently to be taken by the preliminary crusher, which is a Gates No. 21. The stone is taken out by two Marion, 91-ton steam shovels, having 3½-yard dippers, and delivered by the dipper to Western and Kilbourn & Jacobs dump cars. The quarry equipment includes 40 of these cars, together with three Porter narrow-gauge locomotives. At the upper end of the plant there are also ten 12-yard standard-gauge dump cars and one standard-gauge Vulcan locomotive.

The quarry is worked in the shape of an immense elliptical bowl, encircled by double narrow-gauged tracks with convenient switches for moving from one to the other.

The fact that this new plant is located on the site of an old plant has been of considerable advantage in designing the new structure. This is because a considerable amount of quarry was already excavated, making it possible for much of the crushing machinery to be located at a very low level, doing away with the necessity of a long upward haul of the rock from the quarry. As a matter of fact the rock goes up only a short incline to the mouth of the No. 21 crusher. The cars are taken up this incline, two at a time, by means of a cable carried by a hoisting drum inside the crusher house.

From the big crusher the stone is taken by a 42-inch Allis-Chalmers bucket conveyor to the top of the crusher house, falling onto a double incline, which carries it two directions into two Allis-Chalmers revolving cylindrical screens. From these screens the stone is carried on Stephenson-Adamson belt conveyers, either on the 30-inch conveyor to the storage house or on smaller conveyors to other crushers to be recrushed. There are four of these smaller crushers, a Gates

Loomis Drill.

No. 7½, No. 6 and two No. 5s. These smaller crushers are situated about midway between the screens and the large crusher below.

At the top of the storage house the stone is again screened into such sizes as are needed, the market demand being for stone all the way from ¼-inch to 4 inches.

The finished product is handled by the Vulcan locomotive and 12-yard dump cars above referred to, with the assistance of a Brown hoist locomotive crane, equipped with clam-shell buckets. Cameron centrifugal pumps are used for keeping the quarry dry.

The machinery is all electric driven, alternating current at 440 voles being secured from the Toledo Railway and Light Company.

The Association Idea.

Regarding organization of Sand, Gravel and Stone producers, this publication is for the present maintaining an open mind. This does not mean that we do not have a definite opinion on this subject, but it means that our opinion is as yet based on insufficient data.

As a general proposition we believe in organization along all lines. We realize that this is the modern method of development, and we do not see why organizations of men in this line should not prove an efficient help in promoting the industry.

Such organizations might be purely local, comprising the producers in a given city, or they might be district organizations, taking in all the producers in any one of the many fairly well defined producing territories. Again there might be some subjects which could be well taken up by a state organization, and perhaps a few for the discussion of which all might meet on a common ground in a national association.

We confess, however, that we have not studied this question from all viewpoints, or obtained on it all the side lights which one should have in order to form an intelligent opinion.

We want information.

We want expressions of opinion from our readers as to what they think of the organization idea. We especially want to hear from officers and members of such organizations as now exist, telling us of the work which is being accomplished.

Write us freely. This is your journal, and your opinion in the matter is just as good as that of anyone else.

Production Cost Important.

The value of Sand and Gravel, like every other commodity, depends upon the supply and demand, together with the cost of production. The cost of production in the present stage of this industry is of extreme importance; for while there are portions of the country almost destitute of this material, most of the states can produce or have available deposits for producing far more material than the country can consume at the present time. But the producer who can place his Sand and Gravel on the market at the lowest possible cost of production need have no fear of competition due to oversupply.

In the solution of these problems a demand has been created for men who have made a special study of economical methods of handling Sand and Gravel. This demand has increased to such an extent that today many of the large and successful Sand and Gravel producing companies, as well as those about to embark in the business, see the wisdom of consulting and co-operating with machinery men who have a wide range of practical experience in these matters. The Gravel producer knows all about his product, its value, demand, cost of production, etc. The manufacturer knows his machine, its capacity, production, etc. The meeting of these two minds and the co-operation they can give results in advancement to industry.

Convincing Facts.

It will be of advantage to pit and quarry owners to have actual figures at hand to show customers the advantage of clean, graded aggregates over those that are dirty.

At the time of the 1916 Cement Show in Chicago a series of tests was made on 6x12 inch concrete cylinders, the results of which indicate clearly the increase in strength secured with clean and well-graded materials as compared with dirty aggregates and bank-run Gravel; also, the weakening effect produced by an excessive amount of water in the mixture.

The cylinders for these tests were made at the Structural Materials Research Laboratory, Lewis Institute, Chicago, under the direction of Prof. D. A. Abrams. The following is a summary of the results of the tests:

CLEAN AND DIRTY AGGREGATES

Proportions, 1:2:4.
Clean Gravel has 1.2% silt.
Dirty Gravel has 4.3% slit.
Loads are given in pounds per square inch.

	Clean	Dirty
Age 14 days (each result an average of 3 tests)....	1940	1640
Age 28 days (each result an average of 27 tests)....	2750	2220

1:2:4 vs. 1:6 (Bank-Run Gravel)

	1:2:4	1:6
Age 14 days (each result an average of 3 tests)....	2050	1510
Age 28 days (each result an average of 24 tests)....	2660	2020

Normal and Sloppy Mixtures

Normal—about 6.75% water (by weight of total dry material).
Sloppy—about 9.10% water (by weight of total dry material).

	Normal	Sloppy
Age 14 days (each result an average of 2 tests)....	1740	1240
Age 28 days (each result an average of 14 tests)....	2800	1860

A study of the above results shows that there is an increase of 25 per cent in the strength of the concrete at the age of 28 days where clean materials are used; an increase of 30 per cent where a 1:2:4 mixture is used as compared with a 1:6 bank-run mixture, and an increase of 50 per cent where a mixture of what is known as normal consistency is used, as compared with a sloppy wet mixture. A concrete of normal consistency can be further described as containing just enough water so that the concrete will tend to flatten somewhat when piled, but will not flow readily.

Know Your Material.

Every producer of Sand, Gravel and Stone should have an analysis made of his materials, and also should have a series of tests conducted to determine the strength of the materials which he is producing. Especially if a large amount of his product is being used in concrete work should he have tests made of standard mixtures and have a comparison made between the strength of his materials and the strength of standard Ottawa Sand.

Many of his customers will want to know these things and he should have the information ready for them.

Analyses and tests will usually be made at the State University or Engineering Experiment Station; or, if these are not available, samples can be sent to any one of a number of reliable testing laboratories throughout the country. Analyses signed by any of these laboratories will be accepted almost anywhere. These can at times be made a strong feature of a concern's advertising.

High Gravel Bank.

The high gravel bank problem can almost invariably be solved by the use of the power scraper. In eastern Wisconsin a Gravel company owning a valuable piece of Gravel property solved their bank problem by the use of this device. At this plant Gravel is being excavated from a bank 30 feet to 40 feet high and conveyed a distance of 150 to 350 feet. The point of discharge is a hopper leading to a large gyratory crusher. The Gravel, in going through the crusher, falls into a boot, where it is picked up by a bucket elevator and carried to the washing and screening plant. The entire working crew of this plant consists of but three men, including the foreman.

SIDE LINES FOR PITS AND QUARRIES.

There may be said to be three classes of producers of Sand, Gravel and Stone. The first class comprises those concrete contractors and concrete products manufacturers who have their own pits or quarries to provide aggregate for use in their own business. In the second class will be found concerns who are in the Sand, Gravel and Stone business on a commercial scale, doing no contracting or manufacturing themselves, but specializing in the production of materials for sale to contractors and manufacturers. The third class will comprise men of the second class who have seen a possibility for adding some branch of contracting or manufacturing as a side line.

The number of men in this latter class seems to be increasing at a fairly rapid rate, and there would appear to be no reason why this increase might not be reasonably steady from this time forward.

Whether or not a Sand and Gravel producer can go into most branches of contracting work to advantage is an open question. Contracting requires shrewd business ability and the contractor must either have considerable technical knowledge or be able to employ some one who has. Contracting also requires, usually, a considerable amount of equipment.

In many lines, too, such as building construction, the amount of aggregate used is comparatively small. The aim of the producer, if he is going into a side line, should be to engage in something that will require a relatively large amount of aggregate, and not too much constructional skill. One would scarcely expect, for instance, that a Sand and Gravel producer would undertake the manufacture of ornamental concrete products. There are several reasons for this. For one thing, ornamental work takes a small amount of aggregate and the market is not very extensive; for another thing, specially selected aggregates are very often required, so that the average producer could not use his own product except in the rougher parts of the work; and for still another reason, the average producer is not usually a man of "artistic temperament," his thoughts running to tonnage rather than to nicety of execution.

If a line of contracting is to be taken up it might very well be on such work as heavy foundation work, or still more appropriately, on concrete roads. A large part of a producer's profit usually goes into road work in any event, making him more or less familiar with this field, and often bringing him in close relation with the men who have control of this class of construction. The equipment for road work is not expensive, and a competent and dependable man could be engaged to act as superintendent.

When it is taken into consideration that in a mile of road are used from 1,200 to 2,000 yards of aggregate, this will probably appeal to a number of men in this line of business as giving them double profit on a considerable amount of their output; for it is this double profit which would perhaps be the chief inducement with most producers in taking up any side line.

In considering the manufacture of concrete products, also, the same rule will apply, and the producer will attempt to find a line which will use large quantities of aggregate.

The demand for concrete blocks at the present time is, in some localities, developing very rapidly, so that some manufacturers have been compelled to discard their old means of manufacture and adopt some method which would turn out blocks in much larger quantities. If a Sand and Gravel producer is so located that he can reach such a market, or can de-

We Are the Pioneer Manufacturers of Gravel Washing Machinery

The first gravel washing plant was an "S-A" Plant. We developed the original gravel washing machinery which is still recognized as standard. In fact, the records will show that we actually developed the industry.

Altogether in the past fourteen years we have designed and equipped about 400 gravel washing plants. Each one of these was especially designed—each one has been a *commercial success.* We have turned down orders for a number of plants where the elements of success where lacking. We have turned failure into success for several others by re-equipping with "S-A" Machinery.

We have a strong organization of engineers—and a large plant devoted to the manufacture of the highest grade of conveying, elevating, screening and transmission machinery.

It is to your interest to deal with manufacturers and not jobbers.

"Ask the Man Who Owns One"

The following is an incomplete list of the newer "S-A" plants

Gravel Washing

Los Angeles Rock & Gravel Co.
Scottsville Sand & Gravel Co.
Montana Concrete Co.
Vandalia Railroad.
Standard Builders' Supply Co.
Hawarden Sand & Gravel Co.
H. D. Conkey Sand & Gravel Co.
F. A. Downs Construction Co.
Mason City Sand & Gravel Co.
Jensen & Jensen.
Virginia Sand & Gravel Co.
L. D. Burd.
Wabee Gravel Co.
Summit Sand & Gravel Co.
Geo. J. Hoffman.
Logansport Gravel Co.
Battjes Fuel & Supply Co.
Wabash Sand & Gravel Co.
Macksville Gravel Co.
Mason City Sand & Gravel Co.
Covington Sand & Gravel Co.
American Agricultural Chemical Co.
Madison Construction Co.
Windsor Sand & Gravel Co.
Atwood Davis Sand Co.
Lake County Gravel Co.
Chas. Vivian.
Vigo Washed Sand & Gravel Co.
Interstate Material Co.
H. W. Hawly.
Wabash Sand & Gravel Co.
Kingsley & Pagant.
Pueblo Bridge.
Minden Gravel Co.
C. H. Billings.
Canada Sand & Gravel Co.
C. H. Little & Co.
Beaver Sand Co.
McCraney Sand Co.
Coon River Sand Co.
Downs Construction Co.
Virginia Sand & Gravel Co.
Chicago Gravel Co.
Hoyt Mining Co.

Stone Washing

Brownell Improvement Co.
Peoples Crushed Stone Co.
U. S. Crushed Stone Co.
Big Rock Stone & Const. Co.

"S-A" Equipped Crushing Plants

A. C. Laughlin Stone Co.
France Stone Co.
General Crushed Stone Co.
National Lime & Stone Co.
Bessemer Limestone Co.
Branchton Limestone Co.
Blair Limestone Co.
Standard Lime & Stone Co.
Union Lime Co.
Elmhurst & Chicago Stone Co.
Leathem & Smith.
Greenleaf Stone Co.

We'll gladly supply the address of any of the above for reference or send names of "S-A" plants in your territory

Put your proposition up to us and we'll help you make it pay

Stephens-Adamson Mfg. Co.

Aurora, Ill.

velop a market wherever he happens to be, a business of this kind should yield very satisfactory returns. A Gravel plant usually has plenty of space which could be devoted to a manufacturing plant of this kind, while it is, of course, compelled to have railroad connections, so that a market covering a considerable radius could be supplied.

Almost any line of the plainer class of concrete products could also be taken up, depending to some extent on the nature of the locality and the demand for the various products.

Stone producers are usually in touch with the railroads by reason of selling them ballast. This acquaintanceship can sometimes be used to advantage in selling the railroads fence posts, and sometimes such products as culvert pipe, sign posts, etc.

Concrete drain tile and sewer pipe are other products which, when a market is once developed, demand a steady output of machines and take a considerable quantity of raw materials.

Another advantage in such an arrangement is that these products can be made during the winter when the other business is ordinarily shut down, giving at least some of the workmen an opportunity to keep busy throughout the entire year.

A new company known as the American Sand & Gravel Company has recently opened a plant at Pacific, Mo. The company will do a general business in sand, gravel and stone. It is capitalized at $25,000, all of which has been subscribed and 60 per cent paid up. The company has acquired a tract of about 200 acres, fronting on the Meramec River. Otto Bollman, formerly president of the Bollman Bros. Piano Company, is the largest stockholder in the company. Associated with him in the management of the company will be Jeff J. Prendergast who is experienced in the sand and gravel business.

Biggest Belt.

What is claimed to be the longest belt in the world is at a gravel pit about 16 miles east of Cincinnati, operated by the Ohio Ballast Company.

This company is furnishing ballast for the Norfolk and Western Railway, as well as selling material on the open market.

The belt is a Leviathan belt, made by the Maine Belting Company, Chicago, and was installed in the plant in

March, 1914, on rollers made by the Webster Manufacturing Company of Tiffin, Ohio. Up to September 8, 1916, it was still in service and had conveyed nearly 1,500,000 tons of gravel.

Help Wanted.

This first issue of Pit and Quarry is not up to our ideal of what a pub lication of this kind should be.

We want others to come closer to the ideal.

You can help us on this.

Write us a letter of suggestion, commendation, criticism—whatever is uppermost in your mind. If you like Pit and Quarry, tell us so. If there are some things about it which you think ought to be changed, we shall be glad to know about that, too.

But above all we want helpful suggestions so that each issue may be better than the one before it.

Strength
Flexibility
Service

PERFECTION WIRE ROPE

Unless you want the best you won't be interested in Upson-Walton's Crucible Cast Steel, Plow Steel and "PERFECTION" Plow. They are the ropes found in sand and gravel pits, stone quarries and drag line work, and they are giving satisfaction.

PERFECTION

45 years of Wire Rope Experience back of it

THE UPSON-WALTON CO.
CLEVELAND
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WHATEVER YOU NEED IN PERFORATED METALS

There is no branch of the sand, gravel and crushed stone industry for which we cannot furnish the highest quality of perforated metals and screens at rock bottom cost and immediate deliveries.

NORTMANN-DUFFKE FDRY. CO., Milwaukee, Wis.

PROMPT

DELIVERY

Chicago Cement Show.

The Cement Products Exhibition Company announces that the tenth Chicago Cement Show will be held in the Coliseum, Wednesday, February 7 to Thursday, February 15, 1917, inclusive.

Inasmuch as such a large percentage of the output of sand, gravel and stone plants is used in concrete work, many producers have got in the habit of attending this show. They get in touch with a great many of their customers at this gathering, and they like, also, to see the new developments in the industry. A number of them, through this means, have seen opportunities for themselves in concrete contracting or the manufacture of concrete products, carrying along these lines in conjunction with their other business.

During the eight-day period Chicago will be the center of activity in the building material industry. The National Builders' Supply Association will hold its annual convention at the Hotel Sherman February 11 and 12 and the Illinois Lumber & Builders' Supply Dealers' Association at the same hotel, February 13 and 14. While the dates have not been definitely set, the American Concrete Pipe Association will be in session during the Cement Show, and the American Concrete Institute will meet at the same time. Besides these organizations, it is possible that the American Association of Engineers and other similar associations will convene in Chicago during the show.

In the case of W. L. Scott against the American Sand & Gravel Company at Erie, Pa., the jury returned a verdict for $537.50 in favor of the plaintiff. W. L. Scott sued the gravel company for commissions due him on a large contract for sand and gravel which the company was unable to fill. He was forced to fill the contract with material from another company at a reduced commission. As the American Sand & Gravel Company accepted the order, virtually signing a promissory note to fulfill it and pay the commissions, the jury awarded the damages.

The Mackinaw Sand & Gravel Company, of Lincoln, Illinois, has recently installed a third plant at Decatur. This plant is equipped with the latest washing and screen devices. The officers and directors of the company are J. W. McGrath, T. E. McGrath, T. L. Blackburn, Fred F. Longan and Dean Hill. The company is made up of prominent Lincoln business men and is an institution which enjoys the confidence of the contractors, engineers and building material dealers throughout the state.

A company which has recently been formed to develop the gravel pits at Sam Fordyce, Tex., is known as the Sam Fordyce Gravel Company. The company starts with a paid up capital stock of $15,000. The incorporators are Henry Klossner, A. J. Ross and Calvin V. Lysinger. It will maintain its principal office and place of business at Edinburgh, though its main gravel pit will be located about two miles east of Sam Fordyce, at which point a spur track from the branch line of the St. Louis, Brownsville and Mexico Railway has been built. This track is about three-quarters of a mile in length and it is anticipated one of the largest gravel deposits in the vicinity will be opened up by this company in the near future.

The plant of the National Limestone Company two miles from Martinsburg, W. Va., was sold to Clarence L. Pleaslee and W. W. Jackson of Williamsport, Pa., James S. McAnulty of Scranton, Pa., and U. M. Fells of Towanda, Pa. The price was $200,000. The plant will be reopened on a large scale and several hundred men will be employed.

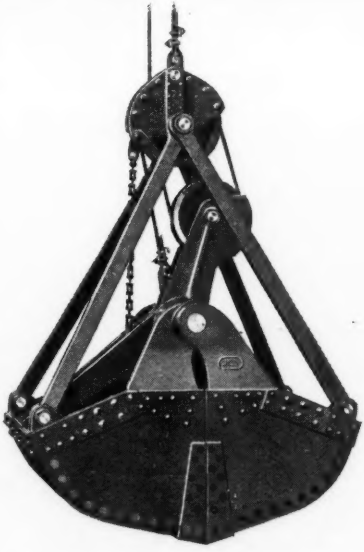
Slate Quarry for Sale!

High Grade, unlimited supply, established reputation in New Jersey. Full particulars mailed. J. Sterling Drake, 29 Broadway, New York, Factories, Water Fronts, Commercial Properties.

EQUIPMENT FOR SALE

No. 6 Gates "D" crusher
No. 4 Gates "B" crusher
Baldwin locomotive 9" x 14", 36" gage
8" x 10" Lambert D.D., D.C. hoisting engine swinger
Lidgerwood 8" x 12" S.D., D.C. hoisting engine
One Guy derrick, Mast 70', Boom 60', Steel bull-wheel
One No. 19 Star Traction well drill
One Elevator, 36" buckets, 60', C. to C. new drive gears
Landis stationary engine, 70 H. P.
Worthington pump 10 x 6 x 10

SUSQUEHANNA STONE CO.
Williamsport, Pa.



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You sand and quarry men know what Blaw Service means

The big BLAW ORGANIZATION stands behind the BLAW BUCKET

The Blaw Bucket has demonstrated in service its GREATER SPEED, ITS DIGGING POWER, ITS COMMON SENSE DESIGN, ITS STRENGTH. In competition with other buckets it has shown greater yardage.

The U. S. Government is working it on dredging.
The Foundation Company has proved its worth.
The Niagara Sand Corporation of Buffalo uses five Blaw Buckets and has adopted them as standard equipmet.

Digging Power, Light Weight, Simple Design, those are the three reasons.

Read the details. Send the coupon for them today.

Blaw Steel Construction Co.

Suite 605 Farmers Bank Bldg.

PITTSBURGH, PA.

BLAW STEEL CONSTRUCTION CO.
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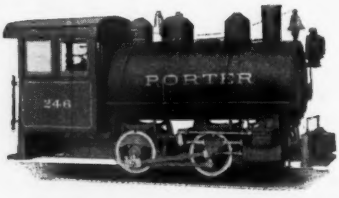
LOCOMOTIVES LIGHT and HEAVY



Locomotives, narrow and wide gauge 4 tons to 100 tons

Steam—Fireless—Compressed Air

Catalogue on application free to intending buyer or user, provided Pitt and Quarry is mentioned

Completed locomotives on hand 24, 36, 56½ inch gauges

Address H. K. PORTER Co., No. 1200 Union Bank Bldg. Pittsburgh, Pa.

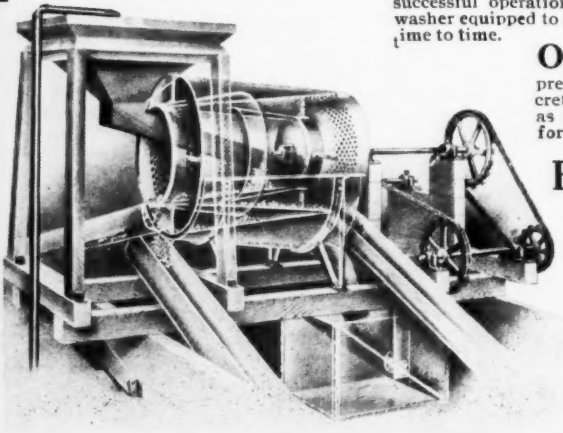
SMALLER
—initial outlay
—operating cost
—space required
—expense for auxiliary machinery

NEW and BETTER

The Biesanz Sand and Gravel Washer is marketed "by request"—in answer to a call to benefit the trade with a money-saving, space-saving, equipment-saving, better product machine—though it was first made for their private use. The

BIESANZ Sand and Gravel Washer

is "different" in these respects; "Nested" screens economize space; the larger-perforated screens having the small surface; the output is uniform; does away with the necessity of high bins, large space, long shaftings, numerous sprokets and high-powered drive. Now in successful operation in large and small plants. Our washer equipped to start with. It can be added to from time to time.



OPPORTUNITY

presents itself in this machine for concrete products manufacturers as well as the sand and gravel man. Write for particulars.

Biesanz Stone Co.
WINONA, MINN.

GREATER
—uniformity of screen capacity
—daily output
—all around profit

SECOND-HAND MACHINERY

CRUSHERS

1 No. 2 Gates D.
1 No. 3 McCully.
1 No. 4 Austin.
1 No. 5 Gates K.
1 No. 6 Gates D.
2 No. 7½ Gates D. & K.
1 No. 8 Gates K.
1 No. 9 Gates D.
1 No. 12 Gates complete plant.
1 48x60 Gates jaw.
Can furnish elevators and screens with all of these.

SCREENS

1 48" x 17' Gates screen, complete.
1 60" x 20' Gates screen, complete.
1 48" x 24' Screen, **complete.**

ROLLS

2 36" x 22" Buchanan Rolls.
1 36" x 16" Superior sand rolls.

CEMENT MAKING MACHINERY

2 5' x 22' Allis-Chalmers tube-mills.
9 6' x 60' Cement kilns, complete.
10 Kent mills.

LOCOMOTIVE CRANES

1 25-ton Industrial (Bay City) crane, 8-wheel M. C. B. 50' boom.
1 20-ton Ohio 8-wheel M. C. B. crane, 50' boom, 1½-yard bucket.
2 15-ton Ohio 8-wheel M. C. B. cranes, 40' booms, with pile-driver attachments, complete.

COMPRESSORS

3 Laidlaw-Dunn-Gordno 30x20x20 belt-driven compressors, capacity 2,870 ft. per min., complete with motors.
3 Ingersoll-Rand "Imperial 10," class X-B-2 belt-driven compressors, capacity 2,400' per min., 28x17x24.
1 Knowles-Blake 16x10x10 belt-driven compressor, 430' per minute.
1 Ingersoll-Rand class N-E-1 belt-driven compressor, 300' per min.

STEAM SHOVELS, NON-REVOLVING

1 Model "250" Marion revolving stripping shovel, with drag-line equipment.
1 Model "100" Marion 5-yard shovel, 136-ton, railroad trucks.
1 Model "91" Marion, 103-ton, 5-yard shovel, railroad trucks.
3 Model "75" Marion shovels, 3-yard dipper, 96-ton.
3 Model "70-C" Bucyrus shovels, 2½-yard dippers, 80-ton.
1 Model "28" Marion traction revolving shovel, 18 tons, ⅝-yard.
3 Type "O" Thew traction revolving shovels, 18 tons, ⅝-yard.

LOCOMOTIVES (STANDARD GAUGE)

3 Baldwin Consolidation, 20x24, weight 70 tons each.
1 19x26 Baldwin 10-wheel locomotive, 180-pound pressure.
1 65-ton Shay geared locomotive, standard gauge.
1 15x22 Baldwin 4-wheel saddle-tank, weight 25 tons.

LOCOMOTIVES (NARROW GAUGE)

8 10x16 Vulcan 36"-gauge 18 ton locomotives, steam-brake.
4 11x16 Porter 36"-gauge 18-ton saddle-tank locomotives.

CARS (STANDARD GAUGE)

50 hopper-bottom 60,000-pound capacity coal cars.
100 Western 12-yard two-way air-dump cars.
25 Oliver 12-yard two-way air-dump cars.
13 Oliver 6-yard two-way air-dump cars.

CARS (NARROW GAUGE)

100 4-yard Western two-way dump cars, 36"-gauge.
25 3-yard Western two-way dump cars, 36"-gauge.
20 36"-gauge 2½-yard end-dump quarry cars.
10 24"-gauge 2-yard end-dump quarry cars.

HOISTING ENGINES

1 10x12 3-drum Lidgerwood cableway engine, 50 H. P.
2 8½x10 Lidgerwood D. C. D. D. hoisting engines.
2 7x10 American D. C. D. D. engines with boilers.

CLAM AND ORANGE-PEEL BUCKETS

2 2-yard Hayward class "E" clam-shell buckets.
1 1½-yard Hayward class "E" clam-shell buckets.
1 1-yard Browning clam-shell bucket.

CABLEWAYS

1 Lidgerwood cableway, complete, 750' span, 10x12, 3-drum main engine, carriers, carriage, etc.
1 Shearer & Mayer 1¼-yard 600' span Lidgerwood slack-line cableway.

STEAM ENGINES (CORLISS)

1 16x42 Lane & Bodley Corliss 200 H. P., wheel 12' x 23".
1 20x42 Hamilton Corliss 300 H. P., wheel 14' x 26".
1 24x48 Hamilton Corliss 500 H. P., wheel 16' x 35".

BOILERS (WATER-TUBE)

6 200 H. P. Babcock & Wilcox McClave shaking grates, 150 pounds.
1 250 H. P. Stirling one-battery shaking grates, 150 pounds.

DERRICKS

1 American steel derrick, 115' mast, 112' boom, with bull-wheel.
1 Stiff-leg derrick, 82' boom, 45' mast, 12' bull-wheel.
1 Guy derrick, 70' boom, 60' mast, steel bull-wheel.

MOTORS

1 450 H. P. Westinghouse CCI 25-cycle, 3-phase, 440-volt motor.
2 75 H. P. General Electric Motors, 60-cycle, 3-phase, 220-volt.
1 40 H. P. Westinghouse 60-cycle, 3-phase, 220-volt.

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735 OLD COLONY BUILDING, CHICAGO

CONTRACTORS MACHINERY & SUPPLY CO

Steam Shovels—Locomotives—Cranes—Cars
Stone Crushers—Rock Drills—Air Compressors

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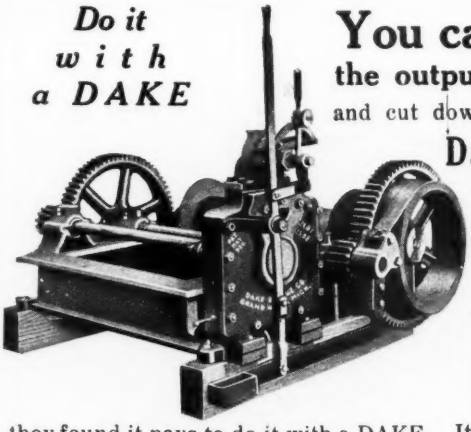
A Few Bargains for Quick Deliveries

1 Marion Model 60—2½ YD Dipper, Late Shop Number $4200. A Number of Small Revolving Traction Steam Shovels. 3 Miles of 24" Gauge Track With Steel Ties, also a Number of Cars for Same.

WABASH BLDG. WIRE—WRITE—OR PHONE PITTSBURG, PA.

Do it with a DAKE



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the output of your derricks
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Dake Swinging Engines

Simple of operation—a single lever starts, stops or reverses the engine instantly—always ready as the engine has no dead center; requires little attention and less up-keep. Used by representative firms from coast to coast—one customer has over eighty, another sixty and so on—Why?—because they found it pays to do it with a DAKE. It would pay you, too. Send for catalog and full particulars that incurs no obligation on your part but a manifestation of your interest.

SWINGING ENGINES, HOISTING ENGINES, DERRICK CRABS, PNEUMATIC HOISTS, ETC.

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NEW YORK AGENT	CHICAGO AGENT	BOSTON AGENT
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We devote our time exclusively to recommending the most economical excavating plant for each particular location.

We have no connection with any builder.

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One 22¼ x 14¼ x 14" Ingersoll-Rand Class "JC" Air Compressor, No. 8130-H. P. and 8131-L. P. Complete. This machine is for all practical purposes, good as new, having been in actual service less than two years.

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MADE IN DETROIT USA

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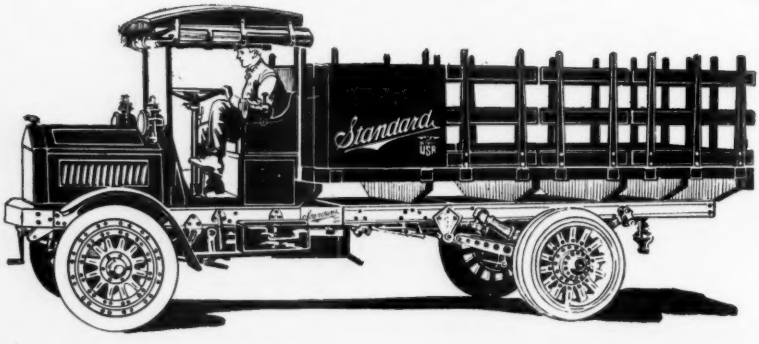
"Repeat" orders indicate satisfied owners. The name "Standard" on a motor truck means all that the word implies. It insures durability, service and satisfaction and the purchase of a Standard Truck is an assurance that your investment will have a higher net earning power, both in truck value and of continuous service. No better proof of this statement is offered than that 65% of the present owners have repeated their orders. This high percentage of "repeat" purchasers, by referring to transportation experts, know exactly how to make comparison and have given the STANDARD TRUCK preference in almost every comparison of value, accessibility, durability, economy and performance.

Cement dealers, contractors and builders have proved to themselves, beyond the question of any doubt, that the STANDARD Truck is the most reliable and profitable investment that they can make, because the design and construction is standard and standardized in every unit.

Are you familiar with the latest STANDARD model? If not, write for catalogue 26-B and list of STANDARD owners, furnished free upon request.

STANDARD MOTOR TRUCK COMPANY

DETROIT, MICHIGAN



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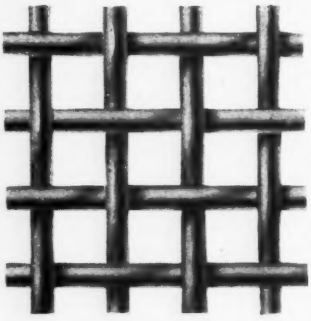

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Large or Small

propositions are handled by us with equal facility and efficiency, by reason of our experience, methods and superior organization. We have designed and supervised some of the largest propositions in this country and also some of the smallest. In every case we have absolutely satisfied our clients. Our plants pay dividends.

WE ARE PRIMARILY ENGINEERS AND SPECIALISTS IN SELECTING EQUIPMENT.

We Specialize in heavy duty Automatic operation.

INVESTIGATE OUR LIME HYDRATOR AND POIDOMETERS.

Portable Crushing Plant, 100 tons per hr. capacity

THE SCHAFFER ENGINEERING AND EQUIPMENT CO., Tiffin, Ohio, U.S.A.

STEAM SHOVELS
FOR GRAVEL PITS

4 70-TON 2½-Yd. ATLANTIC SHOVELS OVERHAULED SOLD UNDER POSITIVE GUARANTEE

The Bucyrus Co. says: The Atlantic type will make higher yardage in average material than can be obtained by any other make under similar conditions.

Contractors say: They steam easier and use less coal than any other. We can show you why.

Write Us Now and Let Us Tell You About Them

UNITED STATES EQUIPMENT CO.

208 So. La Salle St., CHICAGO, ILL.

DUMP CARS—CABLEWAYS—BOILERS—HOISTING ENGINES, AND OTHER EQUIPMENT

A CU. YD. A MINUTE FROM STONE CAR TO WAGON WITH THE "BURCH"

One user of Burch unloaders even reports four loads in three minutes! One minute per load is everybody's average. You can see that there are no waiting wagons at that rate; and it rids you of shovelers' wages. It's practical, strong and rapid and easy to operate. A hauler designed it, and haulers are enthusiastic over it. Simple, compact, and reasonably priced. Write us for particulars—today.

THE BURCH PLOW WORKS COMPANY, Crestline, O.

Thomas Hoists

Electric, Steam and Gasoline

Incline Railway Hoists
Mine Hoists
Dragline Hoists
Builders' Hoists

Two Speed Hoists for
Slack Line Cableway Service
Clam Shell Derrick Hoists

In Thomas Hoists are embodied the results of 20 years' experience devoted to exclusive manufacture of Hoists. We make a hoist for every class of service and have built our reputation on **Quality.** Write for catalog.

Manufactured by **Thomas Elevator Co.** 31 S. Hoyne Ave. CHICAGO, ILL.

BRANCH OFFICE: 126 Pine St., SAN FRANCISCO, CAL.

BUILT IN 10 STANDARD SIZES

The Quarry Crusher and Pulverizer

Reduce the Cost of Crushing and Pulverizing with the

GRUENDLER

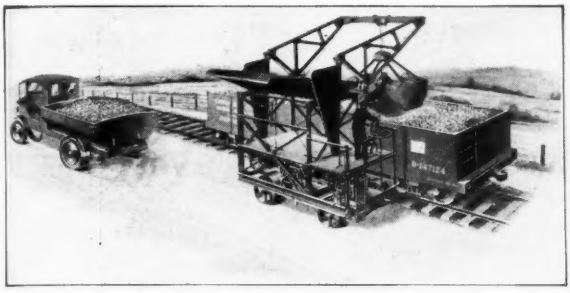
3 to 600 Tons Capacity Daily. Illustration shows heavy duty machine. Our crushers are in wide use for

Barytes	Kaolin	Salts
Carbon	Limestone	Sugar
Cement	Mineral Paints	Tankage
Coal	Ores, all Kinds	Zinc Ores
Copper Ore	Phosphate Rock	Zinc Oxides
Glue Stock	Portland Cement	Fertilizer Material, all Kinds

Write for information on our

FINE GRINDING SYSTEM, USING AIR SEPARATION

Gruendler Patent Crusher & Pulverizer Co., 924-928 N. First Street ST. LOUIS, MO.



The Quick Shovel,

a loading and unloading machine for the quick handling of the bulk material.

The machine is composed of parts of proven success for handling such material most economically.

No waiting of trucks—no demurrage on cars—*no licensed engineer—no fireman* required—let your "handyman" operate this machine and unload cars in one hour's time. This means money to you and service to your customers.

A DOLLAR SAVER IN EVERY SENSE OF THE WORD

Every business man who employes common labor today, should communicate with the *American Quick Shovel Co., Inc.*, to get suggestions as to how this machine could save him money.

Prices furnished upon application

STONE CRUSHING, SAND AND GRAVEL CRUSHING AND SCREENING PLANTS FURNISHED COMPLETE

Our Engineering Dept. invites your correspondence

AMERICAN QUICK SHOVEL CO., Inc.

Engineers, Manufacturers, Labor Saving Machinery

666 Peoples Gas Building : : CHICAGO, ILLINOIS

A FEW OF OUR BARGAINS

Ready for Shipment—In Guaranteed First-Class Condition

BARGAIN PRICES

Lidgerwood drag line, 85 ft. boom, 24 ft. rail circle, 2½ yd. capacity.
Bucyrus steam shovel, 70 ton, 2½ yd.
Thew No. 0 steam shovel, revolving, on traction wheels, ⅝ yd.
Porter locomotive, 24 in. gauge, 8x10.
Vulcan locomotive, 36 in. gauge, 9x14.
Baldwin locomotive, standard gauge, 14x22.
Flory hoisting engine, 7x10, D. C., D. D., with boiler.
Lidgerwood hoisting engine, 8¼x10, D. C., D. D., with boiler.
Lidgerwood hoisting engine, 9x10, D. C., D. D., with boiler.
2 complete sets of cables for **slack line excavator.**
2 **Gates No. 3 "D"** gyratory crushers, rear drive.
Austin No. 4 gyratory crusher, rear drive.
Gates No. 5 "D" gyratory crusher, angle drive.
Gates No. 6 "D" gyratory crusher, rear drive.
Austin No. 7½ gyratory crusher, rear drive.
Allis-Chalmers crushing rolls, 30x16.
4 Tubular boilers, 72" x 20', riveted flues. Hartford allows 150 lbs. for resetting.
12 3½ yd. reversible Troy dump wagons.

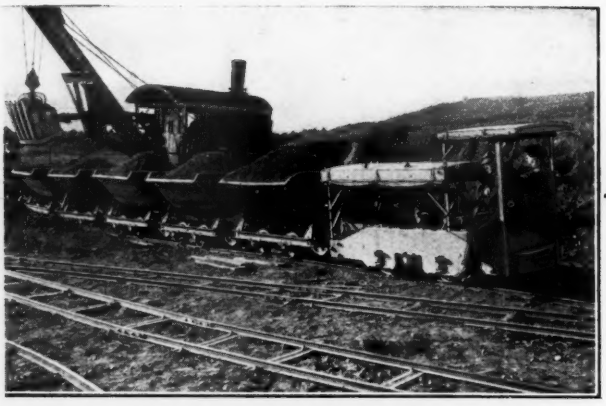
ALSO RELAYING RAIL, DUMP CARS, AIR COMPRESSORS, ENGINES, ETC.

IF YOU NEED ANY EQUIPMENT FOR PIT OR QUARRY

WRITE OR WIRE

MOORE BROS.

New York Life Bldg. **Chicago, Ill.**



This Plymouth Replaced Steam Engine in Herzog Quarries

"Cuts Down Costs In Our Stone Quarry"

—Says Bert Herzog

Steam, as a power hauling system, is more expensive to buy, install and operate than The Plymouth Gasoline Locomotive, according to John Herzog & Son of Patterson and Forest, Ohio. This concern also declares that The Plymouth is more economical than horses or any other haulage system.

The Plymouth

Gasoline Industrial Locomotive

Has These Six Points of Superiority

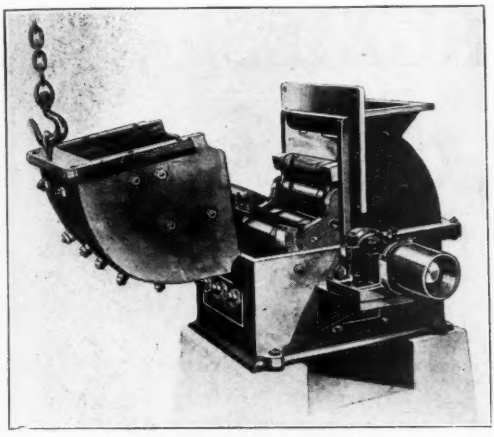
1—It costs less to buy. 2—It costs less to install. 3—It costs less to operate. 4—It costs less to maintain. 5—It has greater draw-bar pull. 6—It has greater traction pull.

Mr. Herzog Proves These Points—He Says:

"We cannot praise The Plymouth too highly. The Plymouth which replaced our steam dinky, cost us considerable less for installation, and also represents a decided saving in operation cost. We consider The Plymouth far cheaper to operate than horse, steam or other power-driven haulage systems because we save in fuel, up-keep and every other point."

GET THIS BOOK Our new book—just off the press—tells the complete story of this particular installation and of many other installations, giving full description, cost data and other valuable information regarding haulage problems similar to your own. A copy is yours for the asking—send for it today.

The J. D. Fate Co., 206 Riggs Ave., Plymouth, Ohio



No. 1 Brainard Crusher-Pulverizer open for inspection

THE BRAINARD

A Crusher as Well as a Pulverizer

Easily accessible, and works upon the impact principle, making a product for agricultural purposes or top dressing for roads.

Also a full line of Universal and Eureka Jaw Crushers, elevators screens and general quarry equipment.

Send for Catalog Matter

SPECIAL ATTENTION given to machine designing, metal mining reports, quartz mills, cement and crushing plants. Assaying and chemical determination.

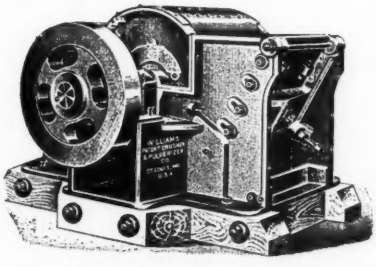
MADE IN FOUR SIZES

Number or size	Largest size feed	Capacity in tons per hour 90% through 20 mesh	¼" opening	¾" opening	H. P. required	R. P. M.	Approx. Weight
0	4"x4"	2 to 4	3 to 5	4 to 8	6 to 8	1000 to 1500	1600
1	4"x8"	3 to 6	4 to 8	8 to 15	10 to 12	900 to 1400	2600
2	6"x12"	8 to 12	10 to 15	20 to 35	20 to 22	800 to 1200	5400
3	10"x20"	18 to 24	20 to 28	60 to 100	40 to 50	600 to 900	17000

Mechanical, Mining and Metallurgical Engineering

MIDLAND CRUSHER PULVERIZER CO., Old Colony Bldg. Chicago, Ill.

FROM 14" TO 18" CUBES TO 1½"- 1"- ¾"- ½" IN ONE OPERATION



BY using Williams Jumbo Crushers to take the feed from the very large Gyratory Crushers, the smaller or intermediate crushers, which were formerly necessary, can be eliminated as the Williams Jumbo Crusher will reduce these large cubes ranging in size from 14" to 18" to a product either 1½"-1"-¾" or ½". Capacities from 60 tons per hour to 200 and 300 tons per hour. Complete description of this extraordinary crusher is given in

BULLETIN NO. 85

THE WILLIAMS PAT. CRUSHER & PULVERIZER CO.

Gen'l Sales Dept., Old Colony Bldg.,

CHICAGO

BARGAINS
IN
Contractors, Gravel Pit, Stone Quarry and Railway Equipment
ALSO
Shop and Electrical Equipment
New and Second Hand

E. F. HAYWOOD, JR.
Old Colony Building CHICAGO, ILL.
Phone Harrison 7572

QUARRYMEN!
Bargains for Immediate Shipment

Crushers
1 No. 12 Gates style "K" crusher, elevator and screen, good as new.
1 No. 9 Gates "K," perfect condition.
1 No. 8 Gates "K," first-class.
1 No. 7½ Gates "D," overhauled.
1 No. 6 Gates "D," first-class condition.
1 No. 5 Austin, fine condition.
1 No. 5 Gates "K," right-angle driven, good.
1 No. 4 Austin crusher, first-class.
1 No. 3 McCully, just overhauled.
1 48x60 Allis-Chalmers balanced jaw crusher, good as new.
1 18x36 Farrell Blake type crusher, extra parts, perfect.
1 48" Symons Disc crusher, first-class.
1 24" Symons Disc crusher, first-class.

Elevators
1 No. 12 Gates elevator, 60' centers, fine.
1 No. 9 Austin elevator, 60' centers, good.
2 No. 6 Gates elevators, 45' centers, first-class.
1 No. 5 Austin elevator, 40' centers, first-class.
1 No. 4 Austin elevator, 30' centers, fine.

Screens
1 60" x 20' Gates screen, perfect condition.
1 48" x 16' McCully screen, good as new.
1 40" x 16' Austin screen, good as new.
1 40" x 12' Austin screen, with dust jacket.
1 36" x 10' Austin screen, first-class.

Shovels
1 Model "250" Marion stripping shovel and drag-line.
1 Model "75" Marion, extra long boom, good as new.
1 70-C Bucyrus, 2½-yard, overhauled.
1 55-ton Bucyrus 2½-yard shovel, good condition.
2 No. 3 Thew revolving shovels, railroad trucks, good shape.

Also snaps in Locomotives, all sizes and gauges of Dump-Cars, Hoists, Boilers, Engines, Rolls, Ballast Cars, etc.

Send us your inquiries and let us save you some money.

MARSH-BOTHE MACHINERY CO.
Old Colony Building, CHICAGO, ILLINOIS

Less than 1 cent a yard

to operate this

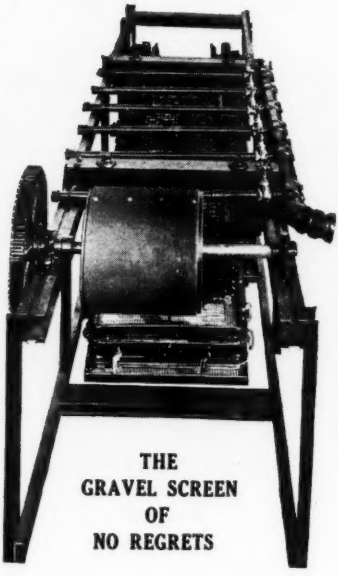
E. & S.

Shaker Screen

with

Washer Attachment

(Patented)



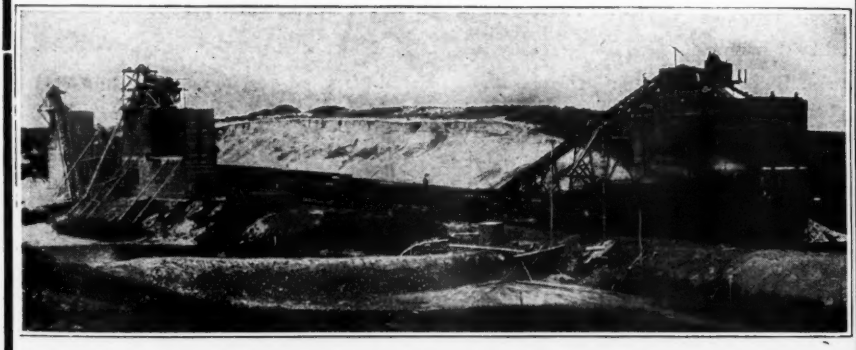
THE GRAVEL SCREEN OF NO REGRETS

This price is not arrived at by theory or from an experimental plant. It is the figure of an actual commercial plant which is turning out 60 yards per hour of perfectly graded and cleaned sand and gravel of five different sizes.

In the plant on the right, shown below, our E. & S. Shaker Screen with washer attachment (above actual photo) replaced a $30,000 outfit of a different type, part of which still standing as shown on the left of the photo.

These E. & S. Screening Machines are not an experiment, having been in use for the past six years and the first installed are today doing first class work.

The machine has an exact eccentric motion which gives the screens a decided "throw," enabling them to turn out more material at less cost than any other screens with the same capacity. They do not have to be placed high in the air, the short distance to which the material must be raised not only reducing the operating cost, but the cost of belting and conveyors.



We Design and Install Complete Plants

Send for Catalogue and information on the E. & S. Shaker Screens and Conveying Systems

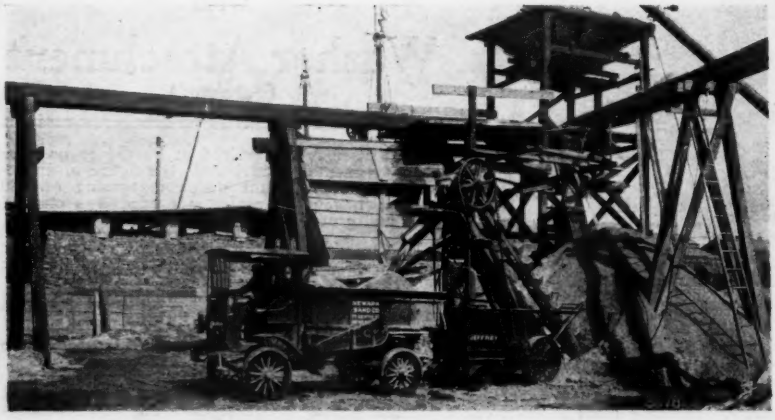
THE EXCAVATING & SCREENING MACH'Y CO.

748 Security Building **Minneapolis, Minn.**

The High Cost and Scarcity of Common Labor Demands the Use of a

JEFFREY SELF-PROPELLING WAGON and TRUCK LOADER

For Handling Your Materials from Ground Storage



Jeffrey Self-Propelling Loader handling 1 to 1½ cubic yards of Sand per minute, Newark Sand Co., Newark, N. J.

The Jeffrey Self-Propelling Loader

Handles 1 to 1½ cubic yards of Sand, Gravel, Crushed Stone, etc., per minute.

Saves the wages of 2 to 5 shovelers—a big item when you figure $2.00 to $2.50 per day for each man.

Keeps your Trucks, Wagons and Drivers busy, and makes them more efficient.

Has a Self-Propelling Device that enables one man to operate the machine, feed it into the storage pile and move it about under its own power.

Is equipped with Collapsible Elevator—which enables it to pass under low overhead obstructions.

Bulletin No. 177-90 has interesting facts telling about the Big Savings it has accomplished for many Contractors, Building Supply Dealers and others in handling their Sand, Gravel, Crushed Stone, Coal, etc. It will show YOU how to effect similar savings in your own plant. Write for Copy.

THE JEFFREY MANUFACTURING CO.

990 North Fourth Street, COLUMBUS, O.

New York	Philadelphia	Chicago	Birmingham	Milwaukee	Seattle
Boston	Pittsburgh	St. Louis	Dallas	Denver	Montreal